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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/800,957
Filing Date: March 15, 2004
Appellant(s): PATCH, SARAH K.

Paul M. Ratzmann
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/26/2010 appealing from the Office action mailed 11/25/2009.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 1, 2, and 4-26.

(4) Status of Amendments After Final

The examiner has no comment on Appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on Appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to Appellant's brief.

(8) Evidence Relied Upon

6,216,025 Kruger 4-2001

U.S. Publication No. 2007/0140541 A1, Bae et al., 6-2007

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 5-9, 13, 16-19, and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kruger (U.S. 6,216,025 B1) in view of Bae et al. (U.S. 2007/0140541 A1).

Regarding **claims 1-2, 9, 13, 16-19, and 24-26** Kruger teaches a method of imaging a breast comprising the steps of: projecting high frequency energy (C4, L46-47, "...microwave or radio wave energy...") toward a breast to induce thermal expansion of

tissue in the breast positioned inside hemispherical shaped imaging tank (Fig. 1, Item 14) having a fluid disposed therein, the fluid having dielectric and ultrasonic properties similar to that of breast tissue (C4, L27-34; C5, L5-8) with an energy source (C4, L49-51; Fig. 1, Item 22) to detect a tumor in the breast (C5, L11-15); receiving ultrasonic emissions from a first portion of the breast resulting from the thermal expansion (C6, L17-21, "Following each pulse of radiation…signals recorded by each of the transducer elements…") by means of one or more sensors placed along an external surface of the tank (Fig. 2, Item 33); generating a first TCT dataset from the ultrasonic emissions (Fig. 12A, Item 92).

Kruger may not explicitly teach creating a second TCT dataset by extrapolating data from the first TCT set. However, in the field of tissue imaging and reconstruction, Bae et al. teach interpolating imaging data from acquired imaging data (para [0054]). Furthermore, Bae et al. also teach that the interpolation process being involved for areas that cannot be accessed by the CT imager (the finer-resolution slices were not able to be generated by the imager for reasons such as time constraints, imaging capacity, or other technology limitations. The areas can thereby be considered non-accessible). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Kruger to include generating a second TCT dataset image data in order to produce a higher reconstruction interval for a 3D dataset (for motivation see para [0054], last sentence).

Regarding **claims 5-8**, Kruger teaches the step of impulsively and periodically pulsing the imaging object (Fig. 12B, Item 108, the step describes varying the period

between a range of numbers, which can be varying "impulsively," or set constant, "periodically."). Also, the RF pulses are both uniform and selective (Fig. 2, Item 14, see the wave propagate in the hemispherical bowl in a uniform manner, as it is selectively sourced from the bottom of the bowl).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kruger in view of Bae et al. as applied to claim 1 above, and further in view of Takashima (JP363211879). Kruger and Bae et al. teach the method of acquiring the first set of TCT data and determining the second set of TCT data. They do not disclose the method of reducing the shading of an image. However, Takashima '879 teaches a method of shading correction by superposing parabolic waveforms or triangular pulses (abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Kruger and Bae et al. to correct the shading of the image generated by the two data sets. Such a modification is advantageous when imaging because the image would be made clearer and easier to view by reducing the shading of it.

Claims 10-12 and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kruger in view of Bae et al. as applied to claims 1 and 13 above, and further in view of Ben-Haim et al. (U.S. 2002/0065455 A1). Kruger and Bae et al. teach the limitations as discussed above. Kruger does not teach using a TCT data set to determine a second set of TCT data through the use of a Legendre Polynomial.

However, Ben-Haim et al. teach the use of a Legendre Polynomial (Para 149). It would have been obvious to a person of ordinary skill in the art to modify Kruger and Bae et al. to include the use of a Legendre Polynomial. Such a modification is useful in assisting in the imaging of the imaging object at remote locations, as evidenced by Ben-Haim et al.'s use of it in determining the location and orientations of remote objects (Para 157).

Claims 20, 21, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kruger in view of Bae et al., and further in view of Ben-Haim et al. Kruger and Bae et al. teach the limitations as discussed above. Kruger does not teach using a TCT data set to determine a second set of TCT data through the use of a Legendre Polynomial. However, Ben-Haim et al. teach the use of a Legendre Polynomial (Para 149). It would have been obvious to a person of ordinary skill in the art to modify Kruger and Bae et al. to include the use of a Legendre Polynomial. Such a modification is useful in assisting in the imaging of the imaging object at remote locations, as evidenced by Ben-Haim et al.'s use of it in determining the location and orientations of remote objects (Para 157).

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kruger in view Bae et al. as applied to claim 20 above, further in view of Ben-Haim et al., and further in view of Maas, III (U.S. 6,181,832 B1). Kruger, Bae et al., and Ben-Haim et al. teach all of the limitations as discussed above. They do not teach the use of a computer to reduce partial scan artifacts in an image. However, Maas, III teaches the

use of a computer to reduce motion artifacts from image data (abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Kruger, Bae et al., and Ben-Haim et al. to include the computer to reduce the motion artifacts from image data as evidenced by Maas, III. Such a modification will yield in a more accurate image if the patient inadvertently moves (C1, L35-46).

(10) Response to Argument

Introduction

A) The main point of contention is that Appellant argues that the combination of Kruger and Bae et al. do not suggest or render the claimed subject matter obvious (page 8 - first paragraph of page 10).

B) Examiner will begin with a brief description of the background of medical imaging. Historically, researchers in the field of medical imaging has striven to create better images using data acquired by an imaging means (MRI, CT, X-ray, Ultrasound). Raw data collected from the sensors/film/transducers of those imaging means are used to reconstruct images based on some mathematical formula or mathematical model. The mathematical formulas vary greatly depending on the creators of these mathematical formulas and the needs of the operator who are using these formulas to reconstruct the resulting images. These mathematical formulas are used to convert the acquired raw data into an image that will allow a human to graphically view the specific patient area of interest in order to diagnose or treat a disease. In the field of image

processing, it is these mathematical formulas that distinguish one invention over another.

C) The invention at hand states in claim 1, "determining a second set of TCT data from the first set of TCT data for a second inadmissible measurement surface..." (lines 4 and 5). This is the limitation that is being argued, and this is the limitation that has been rejected using the combination of Kruger and Bae et al.

Claim interpretation:

D) Examiner first addresses the interpretation of what exactly a "second set of TCT data...for a second inadmissible measurement surface" actually entails. By reciting this limitation, Appellant are trying to emphasize that the mathematical formula being used is going to generate what they consider a "second set of TCT data" from the first set of TCT data. In the claim, "second set of TCT data" is inexplicably linked to an "inadmissible measurement surface". The reason Examiner uses the word 'inexplicably' is because the link between the "second set of TCT data" and the "inadmissible measurement surface" is based on the mere assertion that their mathematical model is actually an accurate depiction of what a "second set of TCT data" would in fact measure if in fact there actually was a second set of transducer(s) (i.e. phantom transducers). For support of this interpretation, attention is directed to figure 1, item 16. The bottom hemisphere is the imaging bowl with real transducers 14 located on the surface of said imaging bowl. The upper hemisphere is an "inadmissible" imaging bowl containing "inadmissible" transducer locations (see also page 1, paragraph [0004], publication of

instant application). In the case of Figure 1, the "inadmissible measurement surface" is considered inadmissible because during imaging, a patient who inserts her breast into the bottom hemisphere will have her body taking up the space shown by the upper hemisphere, where it would be allegedly desirable to acquire more TCT data. Therefore, it should be kept in mind that this "second set of TCT data" does not actually come from a second set of transducers, contrary to what the name "second set of TCT data" suggests. Rather, it is merely the result of a mathematical calculation, based on the first set of acquired TCT data, from which Appellant consider as being "for a second inadmissible measurement surface" (claim 1, lines 4-5). In reality, the second set of TCT data is equivalently just a second set of data that is mathematically determined from the first real TCT data, with the caveat that the second set of data is associated with an inadmissible measurement surface. Therefore, the accurate interpretation of "second set of TCT data...for a second inadmissible measurement surface" would be to imagine a second dataset somehow determined from the first acquired TCT dataset (since the second TCT dataset is determined based on the first TCT dataset, it would inherently also be considered a *TCT* dataset), wherein the second dataset is for an inadmissible measurement surface.

E) The specific interpretation of the word "inadmissible" (see at least claim 1, line 5) should also be addressed prior to the discussion of the claim rejections. Interviews were conducted with Attorney Paul M. Ratzmann after the Appeal Brief filing date of 4/26/2010. In the interview conducted on 10/12/2010, Mr. Ratzmann explained in detail the interpretation of the word "inadmissible", and referenced fig. 1, item 16 as the

inadmissible transducer location in order to argue over the prior art's teaching of "interpolation" rather than "extrapolation" (since the prior art Bae et al. teaches explicitly "interpolation" but not extrapolation, a phantom transducer location located way outside the realm of the real transducer locations 14 of figure 1 would be considered non-obvious given Bae et al.'s teaching of interpolation rather than extrapolation). However, in a more recent phone call to Mr. Ratzmann, Examiner suggested Mr. Ratzmann amend the claim limitations to further define the word "inadmissible" in the same manner that he did in the 10/12/2010 interview, at which point Mr. Ratzmann voiced his opposition to both the suggestion and the restrictive nature of the interview summary dated 10/21/2010. No agreement was reached with respect to the breath of the word "inadmissible", and during the interview the attorney was hesitant to define any bounds at all for the word "inadmissible", including those set forth by the embodiment of figure 1. Therefore, Examiner notes that the current status for the interpretation for "inadmissible" is asserted by Appellant to encompass any measurement surface that can be considered inadmissible, within reason, which would include figure 1's measurement surfaces located in between real transducer locations 14 of the bottom hemisphere of the imaging bowl. Thus, a prior art teaching of interpolation (as taught by Bae et al.) would provide adequate support for meeting the claimed limitation of "inadmissible measurement surface".

Specific response to arguments regarding the claim rejections (pages 8-14, Appeal Brief):

F) Appellant propose that the combination of Kruger and Bae et al. would "at most teach a system having an array of transducers, acquiring imaging data therewith, and reconstructing an image; and the image may be reconstructed on a smaller reconstruction interval by interpolating neighboring slice data" (page 8, first and second paragraphs of Arguments). Examiner notes that even if one of ordinary skill in the art combined Kruger and Bae et al. in the manner suggested by Appellant, the teaching would still read on the claim 1's limitation of "determining a second set of TCT data from the first set of TCT data for a second inadmissible measurement surface..." (Claim 1, lines 4 and 5). The first reconstruction as proposed by Appellant is actually only part of the mathematical calculation used by Bae et al. to generate the "second set of data". After Bae et al.'s interpolation, a "second set of data" is formed (interpolating neighboring slice data). Because Bae et al.'s "second set of data" represents slices in between existing slice data, it is considered data that was previously associated with an "inadmissible" area or "surface". If the area or "surface" was in fact admissible, then that area would have been reconstructed during Bae et al.'s first reconstruction round based on the originally acquired image data, but it was not reconstructed during the first round, and therefore is considered "inadmissible". Appellant' proposed final reconstruction on a smaller reconstruction interval would then read on the claim recitation of "reconstructing an image of the imaging object based on the first set and the second set of TCT data" (claim 1, last two lines).

G) With respect to the arguments drawn to claim 24 (page 8, second paragraph, Appeal Brief), Appellant argues that "claim 24 calls for deriving a second TCT dataset

from a first TCT dataset, the second TCT dataset including data for transducer locations mirrored from the first set of transducer locations". Examiner notes Bae et al.'s interpolation would create a slice in between two existing slices of image data, which can equivalently be considered a "mirrored" location of image data assuming that the mirroring plane is placed in between the newly generated slice data and one of the existing neighboring slice data. With respect to the "transducer locations", it can be readily seen how the newly interpolated slice data can be associated with a "phantom" image sensor location in Bae et al. Since no mirroring plane has been defined by the claims, the "phantom" image sensors associated with the interpolated slice will inherently be "mirrored" if the mirroring plane is set to be directly in between the "phantom" image sensors and the real image sensors.

H) Appellant argues that "Bae et al. is not directed towards manipulation of data prior to image reconstruction, but begins with CT images, and interpolation therebetween to reduce a reconstruction interval" (page 9, first three sentences, Appeal Brief). However, as stated above in section F), Examiner notes that Bae et al.'s second reconstruction as proposed by Appellant is considered the final reconstruction. Therefore, all of the other steps that Bae et al. teaches, including that of the interpolation of the slices, is done before the final image reconstruction. Even though the interpolation is done after the first reconstruction, it is still done before the final reconstruction. Just as a reminder, Appellant proposed that the combination of Kruger and Bae et al. would "at most teach a system having an array of transducers, acquiring imaging data therewith, and reconstructing an image; and the image may be

reconstructed on a smaller reconstruction interval by interpolating neighboring slice data" (page 8, first and second paragraphs of Arguments). Appellant also stated that "Bae et al. teaches refinement of the reconstruction interval" (page 9, line 5, Appeal Brief). Examiner notes that the word "reconstructed" is not defined by the claims to be narrowly interpreted as just a specific one-time technique in the construction of images. A "reconstruction" in the field of image processing can be any number of procedures (typically mathematical) that brings image data closer to becoming the final image seen by an operator. Thus, it can be Bae et al.'s final act of integrating the interpolated images into the 3D volumetric dataset (see paragraph [0054], Bae et al.) that can be considered the "reconstructing" step.

I) Appellant argues that "Bae et al. in combination with Kruger does not teach or suggest to one skilled in the art that the interpolation of data has to do with sensor locations that cannot be accessed, or "inadmissible" or "mirrored" as called for in the claims" (lines 3-6, second paragraph, page 9, Appeal Brief). However, Examiner directs Appellant' attention to section F) above, where Examiner explained:

> "Because Bae et al.'s "second set of data" represents slices in between existing slice data, it is considered data that was previously associated with an "inadmissible" area or "surface". If the area or "surface" was in fact admissible, then that area would have been reconstructed during Bae et al.'s first reconstruction round based on the originally acquired image data, but it was not reconstructed during the first round, and therefore is considered "inadmissible".

A similar argument can be made about whether or not the second dataset is associated with "inadmissible" transducer locations, as recited or implied by claims 13, 20, and 24. If Bae et al.'s sensor locations associated with the interpolated data slice were admissible, then one of ordinary skill in the art would have provided a reconstructed image dataset that did not need to be interpolated further. As with all imaging modalities, hardware restrictions involving the number of imaging sensors are limited, and that limitation would require further interpolation of imaging data for areas not originally imageable by the real imaging sensors. Therefore, interpolation is conducted to further provide image data that was previously unattainable due to the "inadmissible" sensor locations.

J) Appellant also argue that "Bae et al. in combination with Kruger does not teach or suggest to one skilled in the art to reconstruct an image using acquired image data and a second set of data determined or derived therefrom for image reconstruction" (lines 6-9, paragraph 2, Appeal Brief). Again, as proposed by Appellant, the combination of Kruger and Bae et al. would "at most teach a system having an array of transducers, acquiring imaging data therewith, and reconstructing an image; and the image may be reconstructed on a smaller reconstruction interval by interpolating neighboring slice data" (page 8, first and second paragraphs of Arguments). Therefore, the final reconstruction of Bae et al. would involve the use of the use of the both the "second dataset" and the "first dataset" because the "second dataset" is based on the "first dataset" (as explained in the latter part of section F) above).

K) Appellant argues that the limitations of claim 20 are not met because Ben-Haim et al. fails to "teach or suggest that coefficients of a polynomial expression such as the Legendre Polynomial are used to determine data corresponding to a location of the instrument that is inadmissible to the instrument" (page 13, second paragraph, Appeal Brief). However, as explained by Examiner in sections I) and F) above, the combination of Kruger and Bae et al. already teaches the limitation of the transducer locations being "inadmissible". Ben-Haim serves to provide an obvious teaching of using a Legendre Polynomial to extrapolate the position or location of a remote object (para [149] & [157]). Such a teaching provides evidence that using a Legendre Polynomial would be an obvious choice for one skilled in the art to utilize a Legendre Polynomial to calculate other positions or locations, such as for the instant case of determining a second set of TCT data associated with inadmissible transducer locations.

Conclusion:

L) Although Appellant believe that their limitation of "determining a second set of TCT data from the first set of TCT data for a second inadmissible measurement surface..." (recited by claim 1) and associated limitations from the other independent claims are patentable over the combination of Kruger and Bae et al., Examiner strongly disagrees with this opinion. After taking into consideration the claim interpretation and the description of the Specification, it is clear that Appellant are intending to argue an interpretation of the claims that are not in line with what is recited by the claims and described in the Specifications. Examiner reiterates that in the field of image

processing, it is commonplace to acquire image data, create mathematical models or calculations, and then use the mathematical models to create an image that can most accurately depict the physically measured regions and also of unmeasured/immeasureable regions, such as those regions which are interpolated in Bae et al. Merely setting forth claim language that does not distinguish above this concept renders the claims of the instant application unpatentable. It is particularly important for the Examiner to emphasize that the term "second set of TCT data" cannot be interpreted to mean anything more than a second set of data that is determined merely based on a first set of acquired TCT data. Since Appellant are assuming that this second set of TCT data is "for a second inadmissible measurement surface", there really is no way to substantiate that the second set of data is in reality identical to data that would have been acquired by transducers had there been transducers in those inadmissible transducer locations, because data really does not exist for those inadmissible or phantom transducer locations. Therefore, there is no way to distinguish Appellant' second set of TCT data from any other image processing interpolation or extrapolation technique, including the interpolation technique utilized by Ben et al. Also, for the purposes of this Appeal, the interpretation of "inadmissible" should be analyzed carefully and not given more weight than already set forth by the prosecution history (as explained in section E) above).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Elmer Chao/

Examiner, Art Unit 3777

Conferees:

/David Okonsky/

Primary Examiner, Art Unit 3700

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Tse Chen

/Tse Chen/

Supervisory Patent Examiner, Art Unit 3777